Package 'makehams'

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Title Ultimate Select Survival Model (AMLCR)

Version 1.0

Description Implements Makeham's Law (with variable select period), De Moivre's Law, CFM as well as provides various actuarial functions such as moments of insurances and annuities.

Depends R (>= 2.1.1)

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LazyData true

R topics documented:

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annx *EPV of Annuity*

Description

Calculates the Expected Presented Value of various annuities

Usage

```
annx(x = gl.g(x), s = 0, i = gl.g(i), m = 1, n = gl.g(w) - x, c = 0,
  e = 1, mt = 1)
```

Arguments

x	the current age
s	the select used so far
i	the interest rate
m	the compounding frequency
n	the length of the term
c	indicator of continuous (1 if continuous)
e	indicator of endowment (NOTE of an annuity should always be 1)
mt	the moment of the insurance

Details

By default calculates the first moment of discrete, whole life annuity due

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Ax *EPV of Insurance*

Description

Calculates the Expected Presented Value of various insurances

Usage

```
Ax(x = gl.g(x), s = 0, i = gl.g(i), m = 1, n = gl.g(w) - x, c = 0,
  e = 0, mt = 1)
```

Arguments

x	the current age
s	the select used so far
i	the interest rate
m	the compounding frequency
n	the length of the term
c	indicator of continuous (1 if continuous)
e	indicator of endowment (1 if endowment)
mt	the moment of the insurance

Details

By default calculates first moment of discrete, whole life insurance

cfm *Change Survival Model to CFM*

Description

Changes parameters and force of mortality function to use constant force of mortality

Usage

```
cfm(mu = 0.04, delta = log(1 + gl.g(i)), w = 1000)
```

Arguments

mu	the force of mortality
delta	the force of interest
w	the arbitrarily large limiting age

Details

To revert to makehams use makehams()

createInsuranceTable *Create Insurance Table*

Description

Creates a table containing EPV's of whole life insurances (discrete)

Usage

```
createInsuranceTable(x = gl.g(x), w = gl.g(w), d = gl.g(d), n = 5,
  i = gl.g(i), mt = 1)
```

Arguments

x	the starting age
w	the limiting age
d	the select period
n	pure endowment period
i	the interest rate
mt	the moment t calculate

Details

Computes life table using recursion

createLifeTable *Create Ultimate Select Life Table*

Description

Creates a life table based on the select period, radix and Makeham model parameters

Usage

```
createLifeTable(x = gl.g(x), w = gl.g(w), radix = gl.g(radix),
  d = gl.g(d))
```

Arguments

x	the starting age for the life table
w	the limiting age
radix	the number of individuals aged x
d	the select period

Details

See Appendix Tables of DHW 2nd edition

demoivres *Change Survival Model to DeMoivre's*

Description

Change Survival Model to DeMoivre's

Usage

```
demoivres(w = 100, delta = log(1 + gl.g(i)))
```

Arguments

w	the limiting age
delta	the force of interest

Details

Changes parameters and force of interest function to Uniform model

makehams *Change Survival to Makeham's*

Description

Change Survival to Makeham's

Usage

```
makehams(A = 0.00022, B = 2.7e-06, c = 1.124, d = 2, x = 20,
  w = 131, radix = 1e+05, i = 0.05)
```

Arguments

A	model parameter
B	model parameter
c	model parameter
d	select period
x	the default age
w	the limiting age
radix	the number of starting individuals in life table
i	the effective annual interest rate

Details

Reverts the survival model back to Makeham's law with default parameters

tEx *Actuarial Present Value Factor*

Description

Calculates the Expected Present value of a pure endowment insurance

Usage

```
tEx(t, x = gl.g(x), s = 0, i = gl.g(i), mt = 1)
```

Arguments

t	the years from x
x	the current age
s	the select used so far
i	the interest rate
mt	the moment of the insurance

Details

Alternative actuarial "A" notation is also used for tEx

thV *Benefit Reserve*

Description

Uses Euler's method to solve Thiele's differential equation to approximate the value of t+hV

Usage

```
thV(t = 0, h = 1, x = gl.g(x), tV = 0, Pt = function(t) t^0 *
  gl.g(pi), deltat = function(t) t^0 * log(1 + gl.g(i)), bt = function(t)
  t^0, ut = function(t) uxt(t, x), s = 0.01)
```

Arguments

t	the time for which the reserve is known
h	the the time from t for which the reserve should be calculated
x	the age of the person for which the reserve is being calculated
tV	the value of the reserve at time t
Pt	the premium as a function of t
deltat	the force of interest as a function of t
bt	the death benefit payable immediately at the time of death as a function of t
ut	the force of mortality as a function of t
s	the step to use in Euler's method

Details

This function does not take into account expenses

tpx *Survival Function*

Description

Probability that x survives t years given survival to age x

Usage

```
tpx(t, x = gl.g(x), s = 0, uxt = gl.g(uxt))
```

Arguments

t	the number of years to survive
x	the current age
s	select already used
uxt	the force of mortality (can be used to override the default force of mortality)

Details

Uses a default select period of 2 (for makeham's law)

tqx *CDF of Future Lifetime*

Description

Probability that x dies in the next t years, given survival to age x

Usage

```
tqx(t, x = gl.g(x), s = 0, uxt = gl.g(uxt))
```

Arguments

t	the number of years before death
x	the current age
s	select already used
uxt	the force of mortality (can be used to override the default force of mortality)

Details

Calcualted as 1 - tpx(t,x)

udeferredtqx *Deferred CDF of Future Lifetime*

Description

Probability of surviving u years and dying in the next t years

Usage

```
udeferredtqx(u, t = 1, x = gl.g(x), s = 0)
```

Arguments

u	the number of years to survive
t	the number of years to death within
x	the current age
s	the select used

Details

Can be calculated by splitting the CDF. Use tpx(u,x) - tpx(u+t,x)

uxt *Force of Mortality*

Description

The select force of mortality, u[x]+s = 0.9^(2-s) ux+s where the force of mortality is ux+s = A + Bc^(x+t)

Usage

```
uxt(t, x = gl.g(x), s = 0, d = gl.g(d), A = gl.g(A), B = gl.g(B),
  c = gl.g(c))
```

Arguments

t	the years after age x
x	the current age
s	select already used
d	the select period
A	Makeham model parameter
B	Makeham model parameter
c	Makeham model parameter

v *Present Value Factor*

Description

Calculates the present value of a cash flow

Usage

```
v(i = gl.g(i), n = 1, delta = log(1 + i))
```

Arguments

i	the effective annual interest rate
n	the number of years to apply discounting
delta	the force of interest

Details

The force of interest is internally derived from the effective annual interest rate

Index